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THE EVOLUTIONS OF WADERS.

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THE complicated aerial movements which some kinds of Waders perform at times and in certain circumstances are described or mentioned in many of the books dealing with the habits of shore birds. As a descriptive term, "evolutions" is more commonly used than any other word, and thus, apart from the question of its appropriateness, it has custom as well as convenience to recommend it. My purpose is to analyse the simpler forms of the movements, and by connecting the observed phenomena with the conditions under which they are known to occur to suggest an explanation of their nature and possible origin.

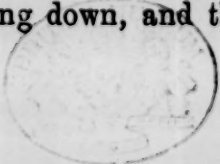
The evolutions of Waders are apparently confined to the subfamilies *Charadriinæ* and *Tringinæ* of the family *Charadriidæ*,* and within these subfamilies to the genera *Ægialitis* (with exceptions), *Tringa* (with exceptions), *Ereunetes*, *Calidris*, and *Limosa*. The small genera *Eurynorhynchus*, *Limicola*, and *Tryngites* occupy doubtful positions. Little appears to be known about the Spoon-billed Sandpiper (*E. pygmæus*), but there is no *primâ facie* reason why it should not exhibit evolutions. As far as it goes, the evidence regarding *Limicola* and *Tryngites* inclines towards the negative. For reasons which will be apparent later the genus *Squatarola* may have to be included, though whenever

* The arrangement followed is that given by A. H. Evans in the 'Cambridge Natural History,' vol. ix., Birds.

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I have seen the Grey Plover (*S. helvetica*) with Waders showing typical evolutions it has always separated from them at the beginning of flight, and when alone as a species it acts in a way similar to that of the Golden Plover (*Charadrius pluvialis*). I have not been able to decide from the descriptions I have read whether the genus *Macrorhamphus* shows typical evolutions, or the form represented by the Golden Plover. This genus is placed in the subfamily *Scolopacinae*; in its habits it is said to resemble *Limosa*. From the information available to me regarding the family *Charadriidae*, and bearing on this matter, I have ventured to set down a number of conditions, all of which are fulfilled by the birds known to me to show these movements. The birds are: (1) of small or moderate size; (2) of gentle disposition; (3) those in which the upper parts are of a pale brown, pale grey, or pale brownish grey colour, and the lower parts more or less of a white colour in winter; (4) those which live in flocks in winter; (5) those which are regular inhabitants of the shore in winter. It is scarcely worth while at present to make out a list of the species of these birds. A greater desideratum would be to learn of exceptions and of the conditions which do not apply to them, and also of species which fulfil the conditions and yet have no evolutions.

The evolutions of the genera named are built up, as it were, on a simpler form of movement generally characteristic of the whole family, and consisting of specifically swift flights in compact strings to windward and to leeward in horizontal planes. The Oystercatcher and the Curlew exhibit these simple movements. The Plovers (*Charadrius*) have added what I call the "reverse." It consists of a sudden rotation of the body from one declination to the other about an imaginary antero-posterior axis passing through the body. When this takes place, as it often does, so that the pale lower parts are quickly exposed to the observer, an effect is produced on the retina as of a flash of light. Plovers show the "reverse" at irregular though frequent intervals. The evolutions proper are often very complex and bewildering, but there is a form of movement which I believe to be the keynote of all of them. Resting on the basis of the windward and leeward movements, it consists of a sudden upcast gradually slowing down, and then curving over into an



increasingly rapid descent. The whole flock, if not too large, enters into the formation of the movement. It may be repeated any number of times, at regular intervals, unless horizontal movement intervenes. It is usually performed on the beat to windward, and with the wings outstretched. During the upcast the under surfaces of the birds are directed towards the sun, and a "reverse" occurs at the summit, so that the descent is performed with the under surfaces turned away from the sun. Thus an observer stationed between the birds and the sun sees a change in the swiftly moving flock from a white and solid to a grey and diffuse appearance. Occasionally the upper surfaces face the sun during the upcast. When this is the case, the "reverse" seldom occurs. So that the evolutions in a relatively uncomplicated form consist of a succession of movements, each of which is made up of a swift drifting to leeward, followed by a beating to windward, and during the latter a rapid sequence of peculiar movements takes place in vertical planes. The vertical movements may attain to little height, or reach a considerable elevation. While there is no hard and fast line to be drawn between the lower and higher forms, the summits of a given series maintain a very uniform elevation. The lower form is that more often seen, and the preceding description applies to it more particularly. The higher form is mainly associated with landing and may want the upcast, the descent being started from a windward or leeward movement in a high horizontal plane. Very often the descent is a slow fluttering movement, the birds being spread out thinly like a sheet, and having their upper surfaces directed towards the sun. Usually, though not always, at a level about equal to that of the summit of the lower form there is a "reverse," causing suddenly a change to a conspicuously white appearance, which is maintained to the end of the movement, and from the time of the "reverse" onwards the descent is hastened. To show the lower form of movement in perfection, the flock should be of small or moderate size, and there should be immediate danger from a bird of prey. A flock of Knots, attacked by a hawk, did not fly away as I had expected. They drifted swiftly to leeward over a short linear distance, and on the windward beat to the starting-point they developed a succession of the lower form of movement. This

device was repeated many times during the several minutes in which the hawk persisted in its attack.

Coming next to the nature of the movements, I suggest that both the lower and the higher forms are imitations of the spray thrown up by the waves of the sea when they meet with solid obstruction. Several considerations warrant this view. The column of sea-spray and the column of Waders each describe a curved path in a vertical plane through the atmosphere. In general form and in detail the two curves have much in common. In both there is a quick upcast gradually slowing down, and, at the summit, curving over into a descent, the speed of which steadily increases until the movement is at an end. In both the upcast column looks white and solid, the descending column is more scattered and reflects less light. The "reverse" of the Waders at the summit of their curve resembles a peculiar movement of the drops of water at the summit of the column of spray. As the water turns over the summit, the particles tend to slip quickly downwards and to one side until the arcuate movement is arrested with great suddenness by the force of gravity. The abrupt change of the strongly reflective drops of water from one direction of movement into another produces the sensation of a flash of light. This effect is similar to that excited by the "reverse" of the Waders. After the column of spray has been propelled upwards to a great height, the descending drops adopt a movement of their own, in addition to the movement of descent. It gives them a glittering appearance, and also slows the descent. These two conditions are simulated by the Waders during the descent of the higher form of movement. During the descent of high sprays the drops of water sometimes alter their form and appearance a second time. This occurs on a level with the summit of the lower spray, and takes place instantly. The drops become blurred in outline, extended horizontally, and more reflective of light—characters which are retained to the end of the descent. The sudden increase of the reflection has its counterpart in the effect produced by the "reverse," which sometimes happens at a similar level during the descent of the Waders in the higher form of movement. One other circumstance to which I have not yet referred is certainly not the least remarkable, and seems to have a more important

bearing on the psychology of the evolutions than any mentioned hitherto. When a column of spray is thrown up, one sees the whole curve complete for an instant before it collapses. That is to say, some particles do not pass over the summit, and only rise in the upcast column to heights which correspond relatively to their heights at the beginning of the impulse. If the flock of Waders is small, the phenomenon is absent, because there is not sufficient material for its production. When the flocks are of moderate or large size, the details are reproduced with wonderful exactness. Those Waders which enter later into the curve ascend the upcast of the column to a greater or lesser height according to their earlier or later entry into the movement, and their ascent comes to a sudden end, wherever they may be, with the general collapse of the form of movement.

It may have been gathered that there are reasons for believing in the defensive character of the evolutions. I propose now to give some of these reasons, and will revert first to the case of the hawk and the Knots. Before the hawk arrived the Knots were resting on an isolated and exposed reef. They rose when the hawk approached, and performed the evolutions I have already described. They continued to do so until the hawk went away. Then they resettled on the rock. During several minutes the hawk made most persistent efforts to break into or detach a portion of the closely packed, swiftly moving flock. The attempts not only failed, but the entire performance appealed to me as being unusually inept for so adroit a bird. Since the date of that event I have seen several encounters of hawks with Knots, and also with Dunlins, and in all cases the results were similar. The Carrion and Hooded Crows attack Waders at every opportunity. If the flock is resting on a reef, the crow approaches cautiously on foot, apparently in the hope of reaching the edge of the flock and seizing one of the smaller Waders. The Waders forestall this move by rising and performing evolutions similar to those shown in the hawk's case. But the crow never follows. It retires a little way, and waits till the birds settle, when the process begins again. The observer is walking along the shore, and sees ahead a flock of Dunlins or Knots. If the birds make their escape by passing him instead of going on ahead, they will probably perform. They rise, and

at first proceed by the direct horizontal mode of flight. Beginning some time before and continuing for some time after passing the observer, they develop a regular series of the lower form of movement, and then resume their ordinary flight. The simpler evolutions may occur at any time under the pressure of an immediate cause, which I believe always to be some form of danger. With this exception, the evolutions, and more especially the complex forms, are confined to the period when the tide is above mean water-level, with a greatest probability of display at or about high-water. There are at least two possible reasons for this circumstance. During the period between half-tide and high-water the supply of food gradually diminishes, following several hours of plentiful and rapid feeding. This would mean that the restlessness prevalent after half-tide is an exhibition of superabundant energy without the usual outlet. That the evolutions are not due to mere restlessness may be inferred from the following consideration. In places where birds of prey are rare or absent, and in early winter before much shooting has taken place, the Waders may, and often do, come in with the flow to the high-water mark and go out with the ebb, without ever leaving the ground. Under what may be regarded as ideal conditions of feeding and security, they prefer to exert themselves as little as possible. This observation should be kept in mind when one attributes to an overflow of energy the extensive displays which occur later in the winter without any cause obvious to casual inspection. The other reason is that the period of high-water is the time of greatest danger actual or potential. The rise of the tide crowds the Waders together, and makes them a conspicuous and an attractive mark. This is well known to man and predatory birds. In many places the Waders are known to leave the foreshore at some fairly definite time before high-water, and go to a distant place of refuge. If the Waders have been much disturbed, the first flock to arrive usually performs more or less extensive evolutions before it alights. Later arrivals generally fly in directly when they see birds of their own kind already settled. The report of a shot-gun, fired at as much as six hundred yards distant from Waders on a refuge, makes them rise and perform their evolutions. At each repetition, as the birds find out that no harm results, the

movements gradually become less prolonged, less elaborate, and eventually are not aroused. When high-water comes late in the winter's afternoon the Waders return in the dusk over the same course as that taken before high-water. They come back sedately in low flying strings, in marked contrast to the generally prolonged displays which they give at the earlier time. On the return journey the dim light increases the Waders' margin of safety to the extent of absolute security. As the winter advances, the evolutions become of almost daily occurrence from half-tide onwards, until the Waders leave for the refuge, and when high-water occurs early in the day they delay beyond the usual time their return with the ebb, so that a landing may be effected on the foreshore out of range. Some of these observations show that the danger need not actually be present. It is sufficient that the memory of a past danger should be fresh, that a place or period should be "notoriously dangerous."

If the view be accepted that the evolutions have been evolved for a defensive purpose, and that the essential form of movement is an imitation of the sea-spray, it is tantamount to saying that the evolutions of Waders are an example of Protective Resemblance within the literal meaning of the words, though I doubt if any definition that has ever been propounded for Resemblance covers the present instance. Resemblance to the intermittent motion of an inanimate object has not, as far as I am aware, been hitherto described, and I have no evidence leading me to believe that deception is practised or intended (unconsciously as by general consent it is assumed to be). On the other hand, there are some reasons for believing that the object is to baffle pursuit or attack. I have not seen a predaceous bird which suggested by its actions any doubt it may have had as to the nature of a flock of Waders. The hawks, in particular, attacked the Waders at sight, and on two occasions were seen to steer a course from a distance directly and without hesitation towards Waders engaged in evolutions. At the same time the close packing of the flock, the rapid and apparently purposeless movements in unexpected directions bring home to pursuers the relative invincibility of the device.

In Britain the principal enemies with whom the smaller Waders have to contend are man, diurnal birds of prey, crows,

and possibly the larger gulls and the owls. At the present time and place man is undoubtedly their deadliest enemy. In places where game protection does not exist, the birds of prey are presumably more numerous and more formidable than they are here, and in former times the same was no doubt true. Further, it is not too much to suppose that the birds of prey preceded man as destroyers, and a time was when their visits to the shore were of daily or even tidal occurrence, in place of being occasional as they now are in the more populous parts of our country. Realizing the important part predatory birds may have played in the lives of Waders in the past, the special development of evolutions by the smallest and weakest of the Waders, and the present success which attends the evolutions directed against the attacks of those birds, I look with some measure of confidence to birds of prey as probably the original cause of these movements.

A difficulty which I do not underrate lies in the application of the present view of things to the more complicated movements. The only way out I am able to suggest is to realize the nature of the movements made under the direct attack of a bird of prey, and to proceed from these to the more complex phenomena, together with a search for the causes that apparently underlie them. Anyone who does so through a series of observations will appreciate the close gradations of the phenomena from the simple to the complex, and in raising a natural order of succession will understand the difficulty of deciding where one form ends and another begins. When they are fully developed the complex evolutions evade general description, and one can only mark their salient features. The most characteristic of these is the movement in the form of the spray, which I believe to be common to all the simple and complex evolutions above the line of the horizontal windward and leeward movements, though it may be discerned only with difficulty, when mutilated or disguised by the operation of special conditions. So also in the search for apparent causes one finds the element of danger common to all, whatever form they may take, and in the case of the more complex evolutions the associated dangers are correspondingly grave. It is a matter for observation that the evolutions assume the most bewildering forms during the

period of high-water, and that the same period is chosen by gunners as most generally suitable for their purpose, the method of election being to lie hidden in ambush near the high-water mark until the Waders are driven within range by the tide. Thus an inference is made that there is a connection between complexity of the evolutions and an implied uncertainty of the Waders regarding the position of dangerous places, or doubt as to the intentions of visible enemies. As the birds move inshore the immediate circumstances revive their memories of former experiences, and lead them into exertions which otherwise they would not feel called upon to make. Hence the addition of far-reaching horizontal, vertical, and oblique movements to the simpler evolutions may be imperative, so as by the freedom and variety of the movements to reduce the possibility of death to an unlucky chance.

I may now bring together the conditions or factors which are associated with or contribute towards the development of the more complex evolutions. When the flock is large the movements are often sectional, and what seems to be a succession of waves passing through an extended flock is in many cases an extremely quick repetition of the simpler form of the evolutions by sections. The "sheet movements" which provide much of the spectacular display are rendered possible by the same circumstance, and generally grow out of the simpler form. They are more especially the manœuvres which take place prior to flight from one place to another, and before this happens they may be greatly prolonged. Throughout the "sheet movements" there are more or less frequent recurrences of the movement in the form of the spray. If the danger is not pressing, greater liberty is taken in developing the movements. But the moment the position and intentions of a human enemy are disclosed, the evolutions generally come to an abrupt end in hurried and direct flight to a place of safety. Above all, I attach importance to two factors in the production of complexity—first, the suspected presence of human enemies in ambush, and, secondly, the period of occurrence when the tide is above mean water level, which really means a reduction of the available area of dry shore, with an associated implication of danger. In the understanding of the meaning of this fact

inherited or instinctive knowledge comes into play, and may explain the actions of the birds when human enemies happen to be absent. I may add that, when the evolutions become complex, they surpass the stage which may be regarded as imitative of the spray. While the simple spray-forms are retained, and are incorporated with the more complex evolutions, these movements evidently cannot be reduced to a common term.

In other words, one may say the simpler evolutions are imitative in character and protective in purpose; in the complex evolutions the simpler imitative movements are partially hidden by the development of a wealth of movement which is still protective in purpose, but which, as regards character, is incapable, at present, of a simple and comprehensive explanation.

AN OBSERVATIONAL DIARY ON THE DOMESTIC HABITS OF THE RED-THROATED DIVER (*COLYMBUS SEPTENTRIONALIS*).

BY EDMUND SELOUS.

(Continued from p. 96.)

July 24th.—*In situ* at 12 (midday), and find one parent, with one chick, at lower end of the loch. From size and appearance I take the former to be the female.

1.9.—Bird off, leaving the chick by itself. It rises from the bay, as is usual, or somewhat usual, with it, having dived there, apparently, and taken me by surprise. I notice that, though it goes off in the usual direction, it makes a wide circle, flying northwards, generally speaking, which would bring it, over various lochs, to another part of the coast. It utters the guttural cry—a sort of deep, short quack—at intervals, and, at first, I think it has seen me, but as it does not return, and keeps circling about, I am in hopes it has not, or that, at least, sitting quiet here, in my accustomed place, it has not minded me.

Shortly after this, the chick, thus left on the water, disappears. When I last saw it, it was, I think, in or near the bay. The other chick I have not yet seen, and the loch now, at 1.30, seems empty.

1.50.—All at once I see a Diver, at the near end of the loch, just skimming over the water, in flight, and the next moment it is hidden by the rising ground, behind which lies most of that little side-shoot of the loch, which I have grandiloquently called the bay, at the entrance of which I, at the same time, catch sight of the chick, again, just before he disappears into it. A moment or two afterwards, I hear, some way off, the guttural “awk, awk, awk” of a Red-throated Diver, in the air. From this it would appear that the other bird—the male of the pair—has been sitting all the while—no doubt with the other chick—in the usual place at the far end of the loch, and that he has now dived down to this end, and flown away—since he could not have swum down the loch without my seeing him. The second chick has, no doubt, been left sitting on the bank, as before.

3 p.m.—The female flies down on to the loch with a long-looking fish, of much larger size than is usual, in her bill, and, in a moment or two, after seeming to be pleased with her prize, she dives with it, and disappears for a little while, after which she and the chick appear, swimming out of the bay together, and go up to the other end of the loch, but do not round the resting-point, as I may call it, nor does the second chick, which I suppose to be, all this while, there, appear. The female bird has therefore been away for two hours, all but nine minutes, having left at 1.9. The male left at 1.50, and has not yet returned. The female now keeps at the upper end of the loch, with the chick, but without rounding the point. I put down the glasses for a moment to make this entry, and, before I do make it, raise them again. The second chick is then also with her, and the three now swim down the loch together. It is pretty now to see the chicks, who are still quite small, going through the same preening and flapping actions as their big parents. They turn on their sides, in the water, showing, not a large white, but a small grey under surface, and thrust out and waggle behind them a bluish-looking webbed foot, which looks as large as their heads. Then, stretching up their little bodies in the water, they flap their little wings vigorously, after which one of them dives. At 3.30 all make up the loch, and disappear and reappear again, round the point, several times. They then retrace the loch, when the mother, diving away from both, into the bay again, appears the next moment, on the wing, rising above the hillocks that enclose it. This is at 3.40, and in just two minutes she comes down on the water again, but without bringing a fish. During her absence the chicks have swum up the loch by themselves, and one has gone round the point, but the other keeps out on the open water. When the mother returns (first just outside the bay, and then across to her usual point at my end of the loch) this chick gradually works its way down to her, and the two are now together again. Thus the usual position of affairs—one chick with the mother, on the water, at one end of the loch, and the other at the other end, resting, probably on land, round the point—again obtains. It is now just as it was before the female flew away, for a fish.

4.8.—Female off again, *via* the bay, which she enters, skim-

ming the water, and then appears, again, above the hillocks just as before. I now follow her flight for a long time—or rather way—first with my eyes and then with the glasses. She goes high in the air, beyond the farthest line of hills, in the direction of the sea, so that she must, I think, when I lose her, be over the sea, following the coast-line, and prepared, it may well be, to descend into some accustomed bay or inlet. Why she does not go more directly to the point I do not know, but a circling mode of approach seems customary with these birds. The chick, again left to itself, goes, as before, into the bay.

4.35.—Female down again. She descends at the upper end of the loch, but without touching the water, glides just over it with her wings raised, and not pulsating, and disappears into the bay—a very graceful performance. I unfortunately forgot to make a point of seeing whether she carried a fish, but, as I cannot remember that she did, I feel sure she did not, for had she done so it must have struck me. Now—at 4.40—she and the chick come swimming out of the bay. They swim up to the head of the loch, and are joined, as before, by the other chick, coming from beyond the point. They swim down the loch again, and, as the chicks press after the dam, she dives once and then again. The second time she must have come up in the bay, into which the chicks swim, and at present I see no more of any of them. I should have thought that the mother was off again, but for the chicks staying there—for, were they left alone, they would probably go up the loch. At a few minutes past 5, one of the chicks issues from the bay, and this poor little thing (for I believe it to be the unfed one) swims all the way back to the point, by itself, and disappears round it, first, however, going round another point, at the opposite side, from which it soon comes out. I thought, from this, that the mother had again flown away, but, walking till my eyes were just above the crest, saw both her and the other chick in the bay, and retreated without having disturbed them. In a little while they swim out and up the loch, and then back again, without being joined by the chick that has gone round the point. At 5.30 the female again dives into the bay, followed by her chick. As far as I have been able to observe, therefore, one chick only has been fed from 12 o'clock, it being now 5.30, and that one only once.

This seems a long interval, but is it only when the fish is seen carried in the parent's bill that it is brought to the chick? A small fish may lie hidden in the bill, or, again, one might be disgorged. I am inclined to think that this is the case, for what, otherwise, is the import of these successive journeyings of the female bird to and from the loch? In one of them, indeed, the time spent away was, perhaps, too short for a fish to have been caught—viz. two minutes—but not, presumably, in any of the others. Another point presents itself. Since, now, during five hours and three-quarters, the two parent birds have never once been in my sight, on the water, together, the bird that I saw go off, at 1.50, and thought was the male, may have been the female after all. If so, then the male has not been here at all. But, as I write this, at 5.53, a bird flies in with a long, shining fish, and, coming down on the water, just off the point so often referred to, the chick at once appears round it, and tears, as one may say, over the water for its meal. Having eaten the fish, both it and the parent disappear round the point, and very shortly afterwards—a matter of seconds—the other parent—for it can hardly by possibility be the same—appears just outside the bay, at the opposite end of the loch, swimming very placidly, and with its head turned *towards the point*. The same bird would hardly have dived the whole length of the loch, and come up with its head in the opposite direction to its course under water. I think, therefore, that this bird bringing in the fish must have been the male, and the other the female, who had been in the bay all the time—nor had I seen her fly out of it. This is the first time, too, that either of the birds, in returning, has come down off the point, just round which the male, but not the female, is accustomed to sit with one of the chicks. The bird that appeared off the bay very soon dived, probably going back into it, since there was no reappearance. Assuming, as I believe to be the case, that it was the male that flew off at 1.50, and that came back with a fish at 5.53, then there seems a tendency for the duties of the two parents to become more distinct, and keep them more apart, each attending to, and feeding, one chick. It appears also (studying this pair) to be the male only who sits on the bank—at least for any length of time—with one of the chicks, but not the other, and who feeds

this chick, the female, for the most part, keeping with the other at the other end of the loch, on the water, and feeding this other one. Assuming that the female, at each coming back to the loch, brought her chick something, then this one was fed much better than that of the male, who only got one fish from his father between 12 and 5.53—I do not know how shortly or how often he had been fed before 12. On the other hand, I cannot be certain that both chicks did not get something from the mother, though I do not think so; and again—this perhaps presumably—she may never have brought anything except when I saw it in her bill.

On my way back I found two well-grown chicks of the Red-throated Diver, in a quite small loch, and, going round it, found both the nest and sitting-place, without any possibility of being mistaken, or of confusing the one with the other; for whilst the latter—the sitting-place—though well-marked—as also the six inches or so of track between it and the water—was a depression in the grass only, the former—the nest—also upon the grass—had been constructed with non-growing grass or other herbage that had been brought and laid there. It was close to the water, on a little peaty island, just off the shore, and quite unmistakable. So well ought a nest, such as this, to serve as a sitting-place, that it seems strange another should be preferred, but it would appear that when the nest has once been left it is not returned to.

July 26th, 1910.—Got to the loch about 11.45 a.m., and made two careful stalks by the aid of some small stone-piles that I had put up yesterday, in order to see, if possible, the male bird in his resting-place, with the one chick; but in this I was not successful, since the parent bird was away. The chick, however, was, I feel sure, up there, but I did not see him till he had seen me first, so that he first appeared on the water at that end, and began to work his way down to the further end, where he joined his other parent, and chick, in the bay. Here they all three were when I got into a new position, which gave me another view of the point, and greater part of the bay, though less comfortable and not so well concealed. At about 1.20 or 1.25 the male flew in with a fish, and, swimming up with it, the whole family were now together. The male took special care to

give his fish to one of the two chicks, and not the other, seeming, by coming directly up to this one, and, I think, pushing him on a little, to separate him from the other one, with its parent, so that the two couples were a little apart from one another when he first put the fish he was carrying down on the water, where it was immediately seized by his *protégé*. He then seemed to have no farther care, but floated away, when the other chick made a rush at the favoured one, and endeavoured to get his fish. In this he should not have been successful, since the latter had had the first and best opportunity. Yet the fish did not appear to have been disposed of when the rush was made, and there was some scuffling (with, I think, one dive) between the two. After the feeding, the family began to separate, the male and his chick floating away from the female and hers, into the centre of the loch, whilst the two latter remained a little off the mouth of the bay. The male's chick, however, went on swimming up the loch, and I there lost sight of him, whilst the male himself hung back, turned round, and in a minute or two—at 1.35—flew away. The segregation of the family life, as one may call it, is well seen in all this. When I arrived the mother and one chick were in a bay by themselves, at one end of the loch, and the remaining chick at the other end, in a certain accustomed place, no doubt where the male parent had left him when he flew off to catch a fish, which was before I came. It was only my appearance at his end which sent him down to the other, though he then, as the next best thing, joined his other parent. The male, then, on arriving with his fish, singles out one of the two chicks in a noticeable manner, to whom he gives it, and when the feeding is over the family again divides.

2.37.—I now, for the first time since his going up, see the solitary chick at his end of the loch, but swimming down it. He does not, however, come far, but having passed a little projecting point of the shore, on the opposite side to his special one, goes back and disappears behind it. I did not see him, when he went up the loch, go round his usual point, but he simply disappeared; he may not, therefore, have done so—which would be a fresh departure.

4.30.—Female off. Her flight up from the water is very sudden. Between the time of the last feeding and now, she and the chick

have kept within the bay, floating idly on the water, sometimes keeping for a long time in almost exactly the same spot, sometimes not so stationary, because of the wind, sometimes paddling within a small orbit, and, at intervals, sleeping on the water, with their heads turned backwards and beaks thrust into the feathers of their backs. There is, to-day, a much more liberal allowance of sunlight, which makes the black loch sparkle, and shows to much more advantage the great beauty of plumage of the parent bird. The perpendicular stripings of the neck would, I suppose, be claimed by the followers of Thayer as "obliterative"—therefore protective—but it would puzzle one, I think, to say how this applies in the present case. The stripes seem to produce a prismatic effect (at any rate, through the glasses), which is certainly calculated to attract rather than escape notice—they seem crowned with a rainbow light; again, both the delicate mauvey-grey of the head and neck, and the red patch on the throat, are conspicuous, each in its own way, so that any protective effect of the stripes, were this a reality, would be nullified by them. With what does either of these tints harmonise? From the moment that coloration can be seen at all, the head, neck, and throat of this bird are all most conspicuous, as also the red eye and black beak, with its well-defined, dagger-like outline. Both the stripes and the mauve have, indeed, a peculiar effect, but it is an effect which catches the eye, not one which escapes it. When the bird sat on the little green projecting bank, here, the bluish head, rising above it, was salient enough, and unlike any other shape or colour round about it, either near or far—yet these are its chosen breeding-haunts. It was, in fact, the saliency of this head which first gave me an insight into the habits of the species in this respect. On the surface of the lochs themselves these divers are, at once, seized by the eye, especially their head and neck, about which there is something very distinctive. In short, in their striping, colouring, shape, size, and *tout ensemble* there is nothing protective, unless it be claimed that, by being easily distinguished, they attract only cursory observation.*

5.30.—Female in with the same long, rounded, shiny-looking

* I am not, in this, denying the principle of protective coloration, but the fact is, there are really "two kings of Brentford," and the official crowned one is always encroaching on the throne of his compeer.

fish. She flies straight to her chick in the bay, and, laying it on the water, the latter takes it whilst it is yet leaving her bill, and pouches it with ease and celerity. It is a matter of a moment, and no undue disparity in size between chick and fish now appears. The chicks are bigger than they look. They are still all covered, as far as I can see, with a light brownish woolly down. This gives an idea of smallness, and they do look very small beside the parents, but the latter are big birds. Still, with all this, the fish just brought was a tremendous rations—something like a whole tongue, a good many times enlarged, for us.

A little while before this the other chick came out on the water, but almost immediately retired again. He keeps rigorously at the upper end of the loch, in a sort of little basin which it forms, all by himself, but not now behind that particular point which hitherto he always has gone behind. The same kind of change has been to remark with the female bird and her chick, for whereas they used to be constantly moored, as one may say, in the bend of the loch, on one side, they have now, since a day or so, changed this spot for the bay opposite.

Just before this entry I saw a Red-throated Diver (not one of my pair) make a very fine descent from a height on to a loch only just behind the first rise here. The wings were held raised above the back, pointing backwards, with a sharp bend at the jointure, and thus, without a single beat, the bird stooped most gracefully, and with some fine sweeps—in a leisurely way—on to the water, almost sheer below it. Thus on these narrow wings, in spite of the disproportionate size of the body, such a bird as this can stoop as though it were an Eagle or Heron.

Male in with a fish, and there is now an interesting scene. He comes down in the little loop or pool at the further end of the loch, but does not see the chick, who has changed his place, and does not see him either. He waits off the point, a little, then off the opposite shore, and then begins to dive down the loch in search of the chick, scanning all about, each time, when he comes up. In this way he progresses to a little off the entrance to the bay, within which are the mother and chick, so that the whole of it must be visible to him. He then, instead of entering it, turns and dives up the loch again, and going further within the projection last spoken of—on the opposite side to the one round which the chick usually is—I see him, all at once,

start forward, with an eager motion, lowering, at the same time, his bill, till, with the fish in it, he ploughs the water in front of him. I cannot see the chick come out to receive the fish, but, a moment or two afterwards, the parent returns, accompanied by the latter, and the fish is no longer in his bill. The interest of this observation lies in the conclusive proof which it seems to furnish that each of the parents has a chick to take care of, and which, alone, it feeds; for when he came to the mouth of the little bay, the male, with his fish in his bill, must have seen the other chick with its mother, but, instead of bringing it the fish, he went back again, to continue the search for the other. Having found it, he delivered the fish, and the chick thus fed was the same one that he had singled out to feed in the bay, where it had got, as one may say, by accident, away from its usual abiding place. Thus what I have long surmised is, by the chance of the one chick having changed its place, and neither having seen nor been seen by the parent, made now strikingly apparent.

But this is not the only matter of interest. Having fed his chick the male begins swimming down the loch again; but first I must say that, previous to this, on his first coming down at the other end of it, his mate had swum out into the entrance of the bay, uttering a deep guttural sort of quack, the first note I have heard either of the birds utter, whilst down on the loch. She then swam back out of my sight again, and the incident seemed closed. The male now, however, having fed the chick as described, swims with it down the loch, slowly at first, the chick apparently doing all it can to hinder him—constantly swimming in front of him, and seeming to want him to turn back. Embarrassed, but not deterred by these movements, the male at length dives, comes up near the entrance of the bay, swims on, and there now appears, advancing to meet him, the female. Rounding a bend of the shore—for each bird has kept close in—the two come opposite, and in full view of, each other, when each makes a little flight, and then another, over the water, and as they, each time, end the flight, before sinking down again, they, as it were, walk on the water, as a Penguin walks on the land, bolt upright, with the whole of the white expanse of the under surface, from the legs, or almost, upwards, showing—in fact, as it would seem, a courting or nuptial pose. This is most

salient and interesting, and a fairly exact idea of it is conveyed by thinking of a Penguin running for a few steps, and then, for an appreciable period, standing upon the water, the naked legs or feet just hidden by it. At the end of this mutual display, when the birds ride together on the water, the female again utters the deep guttural quack. After this they both swim into the bay, then, in a moment or two, one of them reappears at the entrance of it, rises in a slant from the water, and is off. Meanwhile, the chick that has been fed, being thus evaded, turns and repairs to its own upper end of the loch again. This may be at about 6.30 to 6.45. There is nothing further to record up to 7.30 p.m., when I leave.

In reference to the above nuptial pose or antic of these Divers—if we consider it as such—it may be instructive to quote from my paper on the Great Crested Grebe, in which something similar, though with an odd addition, is thus described:—

“The two, fronting each other, touch, first, with their beaks. Then the female dives and comes up with a small piece of weed which she lets drop. Immediately afterwards the male dives too, and, coming up with a larger piece of weed, the two again front one another, and, all at once, both of them leap entirely upright in the water, standing, it would seem, on their feet, either upon the water itself or on the mud or weeds just below the surface. They look like two Penguins, and each, as they stand face to face, must have the fullest view of the whole broad silver surface of the breast and body, as well as of the throat, of the other. Immediately after they have assumed this upright attitude, the hen bird catches hold of the dangling end of the weed which the male has brought up, and both, holding it between them, make little waddling steps, now forwards, now backwards, but not going more than a few inches, either way. Having done this for a little, both birds sink down again on the water, the piece of weed, which they had, all the while, held, falling disregarded between them, and then set off swimming for the nest, on the opposite shore.” Thus in each of these species we see a similar pose, in which the points of either are shown to the same advantage; but in the Grebes the idea of nest-building—still persisted in, though without apparent necessity—seems to have mingled with that of nuptial display.

(To be continued.)

NATURAL HISTORY RECORD BUREAU, CARLISLE MUSEUM: REPORT FOR 1911.

BY LINNÆUS E. HOPE & D. LOSH THORPE, Keepers of the Records.

THE year 1911 was a remarkable one in many respects. The coldness of the early months of the year and the heat of the succeeding summer and autumn were not without their effect upon the bird-life of the country. The cold spring slightly retarded migration, and the bulk of the summer visitors were a few days later in arrival than in the previous year, although some individuals were reported earlier.

The earliest reported migrant was again the Sand-Martin, which was seen at Westward, Wigton, on March 18th, the earliest note in 1910 being March 13th, at Crosby-on-Eden. The Cuckoo was reported at Todhills on April 17th, eleven days earlier than in 1910, and the Corn-Crake was recorded on April 27th, the earliest note sent in for 1910 being May 1st.

Many birds finished their nesting early and commenced migration, whilst some species reared several broods and stayed very late, as, for instance, a Swallow was reported sitting on her eggs as late as Oct. 17th. This may have been a third brood.

One or two notes by correspondents seem remarkable and invite comment. On July 4th Major Spencer Ferguson wrote: "Last night twenty Grey Geese passed over Lynehow to Rockliffe Marsh from east . . . time, 8.20 p.m." Mr. J. M. Charlton (a good observer) wrote: "On July 25th a flock of Wild Geese was seen flying north-east over Brampton . . . grey in colour . . . time, 8.30 p.m. . . . seen by two observers." Wild Geese were also seen by other observers near Carlisle towards the end of July. Both correspondents remark on the abnormality of the dates (July 3rd and 25th).

The Wild Geese which visit the Solway Marshes do not, as a rule, arrive until the middle or near the end of September, and they have generally left by the end of April. That Grey Geese

did occasionally stay on into June or even July was well known to Macpherson when he wrote the 'Fauna of Lakeland.' He says, "Geese so notoriously linger late in their winter haunts, *if not breeding birds.*" It is possible that the Geese seen in July last year were non-breeding birds, paralleled by the large flocks of non-breeding Bar-tailed Godwits which sometimes spend the whole summer on the Solway.

In these notes we have more than once remarked on the apparent increase in the numbers of Grey Lag Geese which now visit the Solway, and the birds seen late may have belonged to this species, which as its name denotes is much addicted to lingering or "lagging" late in its winter haunts.

It is with a feeling of great regret that we report the fact that no Wild Swans wintered on the River Eden at Carlisle during the winter of 1911-12, a break in a sequence of six annual visits by this fine species being thus created.

The 'Glasgow Weekly Mail' of Dec. 9th, 1911, reported thirteen Wild Swans on the River Nith at Dumfries, but enquiries proved that they were merely Mute Swans, though perhaps strangers to the Nith.

The 'Times' of July 13th, 1911, recorded the nesting of a Black Redstart at Crosthwaite, near Keswick, and in this case also the result of our enquiries was disappointing. We may, however, congratulate ourselves that the breeding of the Great Crested Grebe in "Lakeland" was in 1911 established beyond doubt.

Records relating to Mammalia are few, but it is interesting to note that the Roe Deer still rears its young in the north-east of Cumberland.

WESTMORLAND AND SOUTHERN LAKELAND NOTES, 1911.

By ERIC B. DUNLOP.

Though the weather at the commencement of the year was more open than at the beginning of 1910, the birds, curiously enough, were considerably later in coming into song. For instance, in 1910 the Song Thrush was first heard on Jan. 4th, in 1911 not till Feb. 12th. The Chaffinch came into song on Feb. 1st, 1910, and on Feb. 17th in 1911.

I saw the first Wheatear, a male, on April 14th. The cold

east wind which had blown for a month previously no doubt made this and other migrants late in arriving. On April 15th the first Common Sandpiper was noted; on April 21st the Swallow and Willow Wren; on April 22nd a male Redstart. The Cuckoo was heard on April 29th.

On May 4th a Whitethroat was seen, and on this date the first House Martins were reported to have returned to a large colony. A Whinchat was seen on the 5th, and on May 16th a Spotted Flycatcher. On May 27th a nesting-hole of the Great Spotted Woodpecker was examined; it contained young fully a week old.

Curlews were unusually late in leaving their upland breeding haunts: normally they have left us before August dawns, but they were still on the hills above Windermere on August 10th. The same delay in quitting their breeding-grounds was noted on the eastern side of Westmorland. Possibly the hot and dry summer had made food difficult to procure, and caused these birds to be more backward than in a more moist season.

The summer-like weather at the end of September caused the Great Tits to utter their spring notes, and the Chaffinches to sing. I do not remember hearing Chaffinches sing in this district at the fall of the year before. On Oct. 26th the first arrival of Fieldfares was noted.

On April 22nd I saw, near Windermere, two Waxwings; they had been seen about the locality for some weeks previously; search after this date failed to reveal their presence. They flew together as if paired.

I have much pleasure in recording, for the first time, the nesting of the Great Crested Grebe in "Lakeland." On a certain quiet sheet of water I saw, on April 18th, two pairs of these fine birds. One pair brought two young off in safety; the other birds were, I believe, also successful in their nesting operations, though I did not see the young as I did in the first case. I have good reason to suppose that they bred in this locality in the two previous seasons.

A Great Snipe was shot near Shap in the autumn, and was subsequently recorded in the 'Field.'

Two pure white Grouse chicks were hatched from the same clutch of eggs near Lazonby. On being handled, they were

found to have the ordinary dark eye of the Grouse. One of the birds was reported in autumn.

The following are a selection of the notes and records sent in to the Bureau:—

January 2nd, 1911.—Fourteen Grey Lag Geese seen near Silloth (W. Nichol).

3rd.—Heard Bewick's Swans in flight near Silloth (W. Nichol).

5th.—Saw about forty Grey Lag Geese at Skinburness (W. Nichol).

16th.—Saw about twenty-seven Grey Lag Geese at Skinburness (W. Nichol).

30th.—Grey Lags again seen at Skinburness (W. Nichol). Hawfinch seen at Newby Grange, Crosby-on-Eden (E. Hodgson).

March 2nd.—A flock of Wild Geese flying north-east passed over Stanwix at 1 p.m.; a second flock passed in the same direction at 3 p.m., about twenty-five birds (L. E. Hope).

10th.—Raven seen near Botcherby by two observers (H. H. Hodgkinson).

17th.—A Tawny Owl flying in a plantation with a Squirrel in its talons; the Squirrel screamed as it was carried away, Westward, near Wigton (R. W. Barwise). A White Stork seen near Raby Cote, Silloth (W. Nichol).

18th.—Three Sand-Martins seen to-day; also a pair of Common Wrens nest-building at Westward, Wigton (R. W. Barwise).

26th.—Three of the Whooper Swans left the River Eden to-day (T. Hudson). Sandwich Terns arrived at Ravenglass to-day, three days later than usual (J. M. Charlton).

30th.—Thirty Wild Geese seen near Silloth by J. Backhouse.

April 3rd.—Saw a Kingfisher at Gosling Beck, near Moorville (J. B. Cairns). First Wheatear seen near Silloth, also at Wigton (W. Nichol).

4th.—The two remaining old Whooper Swans and the three young ones left the River Eden to-day (T. Hudson). I saw a Yellow Wagtail to-day near Silloth (W. Nichol).

10th.—Flock of three hundred Bernacle Geese near Silloth (J. Backhouse).

12th.—Redshank wading in shallows by Weaver's Bank in Public Park, Carlisle (L. E. Hope). First Ring-Ouzel of this year seen, Cumberland (Eric B. Dunlop).

12th to 14th.—Gaggle of forty Grey Lag Geese at Skinburness (W. Nichol).

15th.—The first Common Sandpiper noted, near Troutbeck (Eric B. Dunlop).

16th.—A Swallow seen near Silloth by R. Peat. A Sand-Martin seen on River Irthing, near Brampton, wind from west; also a Siskin uttering its call-note, male Redshanks performing evolutions in air, and Long-tailed Tits nesting, near Brampton (J. M. Charlton).

17th.—Cuckoo heard at Todhills; two Sand-Martins seen near Gretna (W. H. Little).

18th.—Two Swallows and three House Martins seen at mid-day at Etterby Scaur, Carlisle (D. Losh Thorpe). Saw a flock of six Wigeon near Silloth (W. Nichol). Swallow and two Sandpipers seen on River Irthing, also Oystercatcher; a pair of Ringed Plovers nesting on a shingle-bed, River Irthing, near Brampton (J. M. Charlton). Two Swallows seen near Silloth (W. Nichol).

19th.—Heard Tree-Pipit singing near Wigton (R. W. Barwise). Saw Common Sandpiper at Rockliffe; Wild Geese numerous on Rockliffe Marsh (G. F. Saul). Some Swallows have arrived at junction of Caldew and Eden rivers; cold east winds (T. Hudson). Saw a Willow-Warbler near Brampton (J. M. Charlton).

20th.—Saw a Swallow at Floriston (J. B. Cairns). First Willow-Warbler seen at Westward, Wigton (R. W. Barwise). Saw Willow-Warbler at Talkin Tarn (W. H. Little).

21st.—Saw a nest of Grey Wagtail with eggs, Westward (R. W. Barwise). Lesser Terns arrived on the Solway (W. Nichol). Saw two Swallows at Sandisyke, near Brampton (J. M. Charlton). Swallow and Willow-Warbler first seen near Windermere (Eric B. Dunlop).

22nd.—Saw a Swallow to-day at Westward, Wigton (R. W. Barwise). Saw a flock of ten Wigeon and also two Shovelers near Skinburness (W. Nichol). Redstart seen near Windermere (Eric B. Dunlop).

23rd.—Swallow seen at Blackwell, Carlisle (W. Marchington).
Swallow seen at Botcherby, Carlisle (W. H. Little).

26th.—A gaggle of sixty Bernacle Geese at Skinburness (W. Nichol).

27th.—Cuckoo heard near Silloth (R. Peat). Swallows on the Eden near the bridge (D. Losh Thorpe). Corn-Crake heard near Aglionby, Carlisle (W. H. Little).

28th.—Saw Redstart, Whitethroat, and Whinchat near Brampton (J. M. Charlton). Heard Cuckoo near Silloth (W. Nichol).

29th.—Cuckoo heard at Troutbeck, Windermere (Eric B. Dunlop). Swift arrived at Etterby Scaur, Carlisle (D. Losh Thorpe).

May 1st.—Heard Cuckoo and Corn-Crake at Silloth, a fine warm day; Wheatear seen (H. H. Hodgkinson).

2nd and 3rd.—A return of the cold weather.

4th.—Whitethroat and House-Martins first seen near Windermere (Eric B. Dunlop). Saw first Swift to day at Westward, Wigton (R. W. Barwise).

5th.—Swift at Eden Bridge, Carlisle (W. H. Little). Heard Cuckoo and Land-Rail to-day at Dalston (J. Reid). Whinchat first seen at Troutbeck, near Windermere (Eric B. Dunlop).

6th.—Corn-Crake first heard at Westward, Wigton (R. W. Barwise).

7th.—Cuckoo first heard near Brampton (J. M. Charlton).

8th.—Four Wild Swans seen flying west from Skinburness (Capt. Penrice). Weather fine and warm again. Two pairs of Jack Snipe on Drumburgh Moss; they appeared to be paired (J. Smith).

10th.—Swifts seen, Willow-Warblers numerous, near Brampton (J. M. Charlton).

13th.—Heat and thunder rain.

16th.—Spotted Flycatcher first seen near Windermere (Eric B. Dunlop).

18th.—Night-Jar heard and seen; heard Grasshopper Warbler at Todhills (J. B. Cairns). Redstart nesting in wall of an orchard near Brampton (J. M. Charlton).

23rd.—Flock of Fieldfares in Morton Park, Carlisle (G. F. Saul).

June 8th.—A Black Tern seen near Silloth (W. Nichol).

10th.—Nest of Hawfinch under observation near Longtown (J. B. Cairns).

July 4th.—Last night at 8.20 p.m. about twenty Grey Geese passed over Lynehow to Rockliffe Marshes, travelling from east (Major S. Ferguson).

6th.—Woodcock flying over in evenings, Sandisyke, Brampton (J. M. Charlton).

10th.—A male Blackcap-Warbler noted feeding on raspberries, also the adults of a brood of Garden-Warblers, at Sandisyke, near Brampton (J. M. Charlton).

11th.—Saw an adult female Dunlin on the River Irthing; it was changing into winter dress, and probably migrating after breeding on the fells; it was very tame (J. M. Charlton).

14th.—Saw a Mole swimming, also a Roe-Deer with her fawn near the Cambeck, Brampton (J. M. Charlton).

16th.—Heard Corn-Crake for last time this season, Brampton (J. M. Charlton).

22nd.—A large flock of Bar-tailed Godwits (about four hundred), in summer dress, on the shore near Silloth; also about fifty Knots; saw a Skua (W. Nichol).

24th.—Many of the Common Terns at Ravenglass have eggs or young, numbers of the latter being marked with a ring stamped "Wetherby, High Holborn, London"; some of the Sandwich Terns still have young, but most of them have departed. There are also Lesser Terns still with eggs (J. M. Charlton).

25th.—A flock of Wild Geese were seen flying north-east over Sandisyke, near Brampton; they were flying low, and were grey in colour; the time was 8.30 in the evening; they were seen by two observers (J. M. Charlton).

30th.—Nest of Song-Thrush in a garden wall; Oystercatchers piping incessantly in the evenings on River Irthing near Brampton (J. M. Charlton).

August 15th.—Saw four Black-tailed Godwits and a Whimbrel near Silloth (W. Nichol).

18th.—Saw two Greenshanks near Silloth (W. Nichol).

22nd.—Saw three Black-tailed Godwits and two Green Sandpipers near Silloth (W. Nichol).

28th.—A brood of young Grouse flushed on "Faulds Brow,"

near Threlkeld, had long tails and flew like Pheasants; none were shot (G. F. Saul).

September 6th.—Swift seen at Etterby Scaur, Carlisle; also seen on August 26th, 29th, and September 1st (D. Losh Thorpe). Flock of Wild Geese flying south-east over Stanwix at 2.30 p.m. (L. E. Hope).

30th.—A Tern passed flying north over Sandisyke (J. M. Charlton).

October 3rd.—A Swallow sitting on a nest with four eggs in a coach-house at Sandisyke, Brampton (J. M. Charlton). Saw a flock of about forty Grey Geese and one of about twenty Bernacle Geese near Silloth (W. Nichol).

4th.—Two flocks of Redwings seen passing over Sandisyke flying north-east; several Swallows and House-Martins still remain near Brampton (J. M. Charlton). An immature Common Gull noted sitting in a ploughed field near Brampton, apparently resting on migration (J. M. Charlton).

6th.—Only one pair of Swallows and one pair of House-Martins now remain here; the wind is north-east, and a solitary Redwing is flying north (J. M. Charlton).

7th.—Grey Plover passing over Sandisyke, flying east and calling (J. M. Charlton).

8th.—More Redwings making north or north-east over Sandisyke (J. M. Charlton).

10th.—Flocks of Lesser Redpolls passing over Sandisyke. There is a large rookery in a wood on the River Irthing; when the enormous flocks rise the sound is like the roar of the sea (J. M. Charlton).

11th.—A flock of about thirty Wild Geese passed over Sandisyke about 3 p.m., wind in west and mild. Flocks of Redpolls are feeding on the seed of silver birch. About 4.30 p.m. a second flock of Wild Geese passed over in the same direction, Sandisyke, near Brampton (J. M. Charlton).

12th.—A Short-eared Owl in an alder-grove near Brampton; saw four Swallows flying south-west, also a flock of about sixty Redwings (J. M. Charlton).

17th.—The Swallow noted on the 3rd inst. is still sitting on her eggs; the birds are shut in the coach-house each night, Sandisyke, near Brampton (J. M. Charlton).

23rd.—Flock of about fifteen Bernacle Geese passing north over Sandisyke; Herring-Gulls in the fields with Lapwings (J. M. Charlton).

26th.—First Fieldfares (autumn migrants) arrived at Troutbeck, Windermere (Eric B. Dunlop).

31st.—Grey Wagtail at Crosby-on-Eden (E. Hodgson).

November 5th.—Saw a fine male Hawfinch to-day near Lynehow; a great gale blowing (Major S. Ferguson).

9th.—Saw a Whooper Swan crossing over Solport from north-north-east towards Solway, about 2.50 p.m. (Major S. Ferguson).

16th.—Flock of eleven Brent Geese seen near Silloth (J. Nichol).

21st.—Saw a flock of about one hundred and fifty Grey Lag Geese at Skinburness (W. Nichol).

SOME OBSERVATIONS ON THE GLOWWORM (*LAMPYRIS NOCTILUCA*, L.)

BY RICHARD ELMHIRST, F.L.S., Superintendent of the Marine
Biological Station, Millport.

ON the west side of this Station is a rather marshy field, about three hundred yards long, in which Glowworms are plentiful in some years; the southern boundary of this field is a road, outside of which is some rough waste ground about a quarter of a mile across, known as Farland Point. The first indication of *Lampyrus* is generally about mid-April, when larvæ are found crossing the road; this continues during May, and the majority of such larvæ seem to be journeying from the Point to the field.

In June the female Glowworms begin to shine; towards the end of June the males appear, sometimes in swarms. After mating, the female shines less brightly, and soon disappears. In September larvæ are again found on the road, and now the majority seem to head from the field to the Point. A few females may occur quite late in the year; on Nov. 1st, 1908, I found a belated female glowing feebly, the night being mild and close.

Once a female has been located, she can almost certainly be found at the same spot night after night, until she mates; owing to this habit of taking up a stance the same individual can be kept under nightly observation.

The real object of these notes is to record the occurrence of the male Glowworms in swarms, and the results of a few experiments carried out during their presence.

June 26th, 1908, was a bright, hot day, followed by a close evening. On returning home about 11 p.m. I noticed a number of insects outside the window; in my sitting-room I found over fifty male Glowworms on the table, or hanging listlessly on the walls. On one pane (2 ft. by 3 ft.) of a window facing west I counted exactly sixty. On going into the field I could not see some of the females which I had had under observation for

several days, and whose exact locality I knew; however, a pocket electric light revealed them surrounded by often six or more males. The latter shone faintly every now and again, especially when handled. I then put out the lights of the house, and placed on the lawn a red light (photographer's dark-room lantern), a blue light (a candle in a box behind a sheet of blue glass, such as is generally used in laboratories and museums), and an unprotected candle. The males were attracted in dozens by the red light in whatever position I placed it, but ignored the blue light and white light of the candle. On relighting the gas the diffuse yellowish light at the sitting-room window (blinds cream-coloured) became second favourite to the red lamp on the lawn.

The following night there was still a considerable number of males about, but in a few days they had all disappeared, except a few which might be found creeping about the females in the field. My nearest neighbour across the field on the west told me he had been bothered for several nights by dozens of flying beetles coming into his house. I counted over one hundred and twenty females in the course of a single evening in the field to the west of the Station. Yet in the field to the east of the Station, Glowworms were very scarce, three or four at most; this may be due to the presence of hens, or that it is rather further from the Point, which seems to be a wintering ground for the larvæ.

The following summer (1909) I prepared for the appearance of the male Glowworms, and tried them with the red light of a bicycle-lamp; white light of a bicycle-lamp; green light of a bicycle-lamp; blue light of laboratory blue glass; diffuse yellowish white light at window; fluorescent lights got by using screens of (1) fluorescein solution, and (2) 10 per cent. solution of sulphate of quinine.

On June 23rd Dr. Malcolm Laurie joined me, and showed Finsen rays. The lights were thrown through paper cones (rather like the horn of a gramophone), which made landing-stages in which insects could be easily detected on arrival, and which only received those coming direct to the light. I discarded these cones, after one trial, as too cumbersome and too easily displaced by the slightest breath of wind. Dr. Laurie

kept the Finsen rays in operation from 10.45 p.m. to 1.30 a.m., but, owing to unsuitability of the conditions for handling batteries and generating hydrogen, the current was rather intermittent. The only insects which came to the Finsen ray cone were a few small Diptera. This experiment ought certainly to be tried again, and should under favourable conditions succeed in attracting the male Glowworms, since the spectral analyses of Finsen rays and Glowworm light are similar.

In the course of experiments made during June 23rd-29th, both in the dark-room and out-of-doors, I found that red was the most attractive colour to male Glowworms; the fluorescein screen and diffuse white light were the next; quinine solution-screen, blue and green, were ignored; bright white light at close quarters was evidently disliked, and markedly avoided. In the field I set up a long strip of canvas on posts; behind this were placed a number of small stands to support the bicycle-lamps or other sources of light. Within four yards of this canvas screen were seven female Glowworms, five of which remained unmated, after all others which I had located were mated. Several dozen males came close past these females on their way to my red light; the only obvious difference in the conditions surrounding these females being the presence of my experimental lights.

In 1910 the larvæ were late, not appearing on the road until the first week in May; females began to shine about May 20th; by June 16th I had located sixteen, and a few males had appeared. After this I saw practically nothing more of them; possibly a heavy thunderstorm on the evening of June 20th, when 1.18 in. of rain fell in about two hours, may have accounted for this. In 1911 they were very scarce. This year a number of larvæ are already about (April 20th).

In conclusion, the three interesting points are—(1) that female Glowworms often take up and occupy a permanent position; (2) that male Glowworms may appear in flights of at least several hundreds; (3) that male Glowworms, like most insects, show a marked preference for red light, which is curious in this particular case, seeing that the light of the female, which should be specially attractive, is at the other end of the spectrum.

NOTE ON THE OCCURRENCE IN YORKSHIRE OF
TRICHONISCOIDES SARSI, PATIENCE: A WOOD-
 LOUSE NEW TO THE BRITISH FAUNA.

BY RICHARD S. BAGNALL, F.L.S.

IN his great work on 'The Crustacea of Norway,' Prof. G. O. Sars carefully described and figured a golden-yellow *Trichoniscoides*, which he referred to the *T. albidus* of Budde-Lund, but which Mr. Patience has recently shown to be quite distinct from the true *albidus*, the two most easily determined characters lying in the flagellum of the antenna, which, in Sars' species, possesses four instead of three joints, and in the form of the meral joint of the seventh peræopod in the male. Patience has shown that these characters are amplified by very distinct structural differences in the pleopoda of the males.

I have taken *T. albidus*, B.-L., in several localities, often in some numbers, and the impression it gives me in the field is that of a sluggish *Trichoniscus pusillus*, having its dorsal surface of a similar claret or reddish-brown colour, but dull instead of glossy, and the underside noticeably whitish. But Sars distinctly says that his species is of a golden-yellow colour, and linear in form.

Recently I had the opportunity of collecting for nearly an hour on the cliffs near Whitby, which I devoted chiefly to the *Pauropoda* and *Symphyla*, but met with several woodlice, viz. *Trichoniscus pusillus*, Brandt, *T. pygmæus*, G. C. Sars, *Trichoniscoides albidus*, B.-L., several *Haplophthalmus mengii*, Zadd., *Oniscus asellus*, L., *Philoscia muscorum*, Scopoli, *Porcellio scaber*, Latr., and a linear, golden-yellow Trichoniscid, quite distinct from *T. albidus*, B.-L., on the field, and agreeing well with the *albidus* of Sars, for which Patience has proposed the name—

TRICHONISCOIDES SARSI, Patience.

Trichoniscoides albidus, G. O. Sars (nec Budde-Lund), 'The Crustacea of Norway,' ii. pl. lxxiii. p. 165 (1896-99).

T. sarsi, Patience, Ann. & Mag. Nat. Hist. ser. 8, ii. pl. vi. pp. 84-88 (1908).

The species is admirably described and figured by Sars, and compared with the true *albidus* by Patience in the above references.

Distribution.—Yorkshire; under small stones embedded on the clayey cliffs near Whitby, March 20th, 1912. Previously only known from Norway, in the neighbourhood of Christiania.

I have not yet had the opportunity of making dissected preparations from my material, but hope to do so shortly.

NOTES AND QUERIES.

MAMMALIA.

Whiskered Bat in Westmorland.—On April 22nd last Mr. Norman Robinson brought me a Bat which he had caught near Bowness-on-Windermere in broad daylight. I identified it as a female Whiskered Bat (*Myotis mystacinus*), and forwarded it to Major G. E. H. Barrett-Hamilton, who very kindly confirmed my identification. The Whiskered Bat has not, I believe, been previously recorded in Westmorland. The following are the chief dimensions:—Head and body, 48 mm.; ear, 12 mm.; tragus, 7 mm.; hind foot, 6.5 mm.; tail, 30 mm.; lower leg, 17 mm.; longest digit, 51 mm.—D. G. GARNETT (Dalegarth, Windermere).

AVES.

Wood-Lark nesting in Norfolk.—In my "Report for Norfolk" *ante*, p. 131, line 32, "a Woodcock's nest with three eggs" should be "a Wood-Lark's nest." In this district the Wood-Lark breeds regularly in small numbers. Its distribution in Norfolk is rather peculiar; in the eastern half of the county, as well as in the northern part, it is a very rare bird, and here its nest has not been found so far as I know. In winter time, after a fall of snow, two or three Wood-Larks are pretty sure to be heard of on the coast, and an instance occurred only last February, one being seen and heard singing on the 4th by Mr. R. Buxton at the Roman Encampment near Cromer.—J. H. GURNEY (Keswick, Norfolk).

Merlin (*Falco aesalon*).—It is perhaps worth recording that a female of the above was brought to me lately* by one of my sons (A. E. Ll. Pickard-Cambridge). He found it nailed through the head to a "keeper's gallows," but it was too far gone to be capable of preservation. It is a rare bird in this district. During a period of many years I have never seen more than three or four examples of it.—O. P. PICKARD-CAMBRIDGE (Bloxworth Rectory, Dorset).

Long-tailed Duck breeding in Orkney.—In reply to Mr. F. W. Smalley's request for further information (*ante*, p. 35) on this subject, I beg to state that the duck was flushed from her nest containing seven eggs by an observer who is well acquainted with this species.—O. V. APLIN (Bloxham, Oxon).

* This note was dated April 18th.—ED.

Flight of the Common Snipe (*Gallinago cœlestis*).—Although I have spent a good many hours in the field study of the Common Snipe, I was totally unprepared for an amazing experience of this morning (May 2nd). On April 27th I had been timing one bird, and noted that it remained on the wing without a break for an hour and three minutes, and drummed every six seconds at the beginning of the time, slowing down to every eight seconds towards the close of the hour at 1.53. In each case the downward plunge lasted about a second and a quarter. Now, to-day, on the same field, in the western portion of Essex, I watched one bird mounting and plunging in a curious manner. The rise and the fall were about equal in time—say, a little over a second; during the plunge the two outer tail-feathers were outspread apart from their neighbours in the usual way, and the bird dropped at the ordinary angle, but in *perfect silence*. There was no mistake about this, and I appreciated the importance of the observation in its bearings upon the theory of the production of the drumming. In a few seconds the bird began “chipping,” and careering about in the manner familiar to all students of the Snipe. The characteristic rockings during flight were so pronounced that I was actually on the point of taking pencil and paper from my pocket to make diagrammatic notes on the spot, for I had never seen them at so great an angle before. Suddenly it turned and came in my direction at a great speed, flying at an altitude of some six feet above the ground, and calling vociferously, and as it passed me *the bird turned completely over, and sailed along for at least twenty yards on outspread wings, belly upmost!* To say that I could hardly believe my eyes becomes here a bald statement of fact, and not a mere figure of speech, and I felt that this was one of those observations on which one must keep silence; but during the next minute it repeated the manœuvre perhaps half a dozen times, against an excellent background and in the best of lights, and my efforts to convince myself that I had made some mistake were fruitless. Any questions of a trick of light, or an optical illusion, or the possibility of the bird being blotched below with white, were not to be thought of, and I have never been so sure of an observation in my life. I repeat that in its abandoned play this Snipe twisted over suddenly to glide along back downwards—once not more than ten yards from my eyes—and when it mounted again in the air it *plunged back downwards*, although otherwise in the exact posture of drumming, and (as I had noted before) in *perfect silence*. This negative evidence at least seems to settle the office of the expanded feathers of the tail. Later on I saw it beating its comparatively sedate round, and drumming in the

orthodox manner. I ought to add that as it flew past me the tip of its bill was open.

The habit—and I must call it this, rather than the trick of a single highly abnormal bird—seems so extraordinary to me, and so far beyond the acrobatic movements of Rooks or Hawks that I have known, that I am taking the step of writing this note at once, and not waiting until I have sought records of similar observations by others. In my paper on the Snipe in the last volume of 'The Zoologist' I indicated that I hoped to write at greater length on the subject of voice, but I would like to place this present detail on record at once, and hope that others may be led to observe the same action. Possibly it is usual with the bird, and perhaps it has been recorded before; but, if so, a second note will be in no way overloading the subject. When we stand to watch a Snipe circling its zigzag course above an open field in full sunlight, it may seem to possess a transparent life, but really few birds are more difficult to observe, and fewer still that are worthier of persistent study.—FREDK. J. STUBBS.

Snipe nesting in Bedfordshire.—No satisfactory instance of the Snipe having nested in this county has ever been recorded. For the past twenty years I have visited the various localities in Bedfordshire, such as at Flitton and Flitwick Marsh, the low-lying meadows of the Rivers Ouse and Ivel, and again at Newnham, where this bird might be tempted to nest. In such localities it is not infrequently observed throughout the nesting period, and many times by their "drumming" and other nesting actions and calls I have been led to think they must be breeding, but many friends and myself have searched in vain. On April 7th last I noticed two pairs frequenting a very favourable stretch of marshy meadow land that has probably only got into such condition in recent years. On May 2nd I revisited this locality in company with a friend, and after a diligent search first found a nest containing an addled egg and the egg-shells from which young had recently been hatched, and eventually the three young themselves, a day or so old, and after that we flushed another bird from her nest containing four fresh eggs.—J. STEELE ELLIOTT (Dowles Manor, Salop).

Origin of the Social Antics and Courting Displays of Birds.—In reading the recently issued Section 7 of Kirkman's 'The British Bird Book,' I was pleased to find that Mr. Farren supports me in my view that the social antics of birds, as well as their more formal and elaborate courting displays, have had their origin in those violent and often frenzied movements which spring directly from sexual

excitement, and may be described as blind impulses. This, however, is only one-half of my theory, for I believe that under the ever active force of natural selection the habit of nest-building has also grown out of these movements. It was my observations on the breeding habits of the Peewit, more especially, which led me to this conclusion, and, consequently, my paper in 'The Zoologist' (vi. p. 133, 1902)—in which the facts and arguments are more fully stated than in my "Bird Life Glimpses"—should be read from that standpoint, rather than as an attempt to give a full account of the bird's spring activities. I describe minutely certain very significant actions on the part of these birds, which I saw, and endeavour to arrive at their essential character, together with the direction in which, through natural selection, they may have led, or be leading. My views, in this respect, were, if I remember, so fortunate as to win, at least, the tentative approval of Mr. Howard. Otherwise I have heard no further word of them, yet I hope that fellow field naturalists will not allow them to be quite buried alive, for, since this is a fate to which our fraternity, generally, is much exposed, we should stand together against it.

In regard to the hen Peewit's appreciation, or otherwise, of the chestnut feathers of her mate, my paper contains the following note, which I think goes farther than anything which Mr. Farren refers to in this connection:—"The bird now rises and goes a step or two farther off, then again, throwing itself forward, stands, almost perpendicularly, on the breast, at the same time pecking at, and, I think, seizing the bits of grass, near, in the beak. The other Peewit" (the female, as I judged her to be, but, in my opinion, the sexes cannot be distinguished with certainty in field observation) "now comes right up to the rolling bird, and appears to examine the lower tail-coverts, or parts adjacent. I cannot say for certain whether it actually touches them with the bill, but it appears to do so. Upon this, the rolling one flies off, and the other, falling forward, presses with the breast (I think also pecking), not in exactly the same place, but just near it." Here we seem actually to see both the nest-building habits and those of sexual display emerging out of blind sexual movements, but, in regard to the former point, I have not relied solely on my own observations (they include a few other birds), but have quoted, from 'The Zoologist' (i. p. 97, 1897), some of Mr. Cronwright Schreiner's highly suggestive ones on the nest-making of the Ostrich.

As to the female Peewit having herself chestnut-coloured under tail-coverts, I do not consider this a difficulty in the way of sexual

selection. Darwin supposes that, in such cases, the adornment of the male has been transmitted, through inheritance, to the female. Sex, we may suppose, would direct the admiration, and, thus supported, the beauty should not pall, through being shared. Also, on my hypothesis of purposeless actions, due to sexual excitement, being the raw material out of which display, more properly speaking, has sprung, one might expect admiration (by which I mean sexual response, through eye-dazzlement), on the part of the female, to precede any consciousness of exhibition in the male, so that selection might well have proceeded some way before this latter element began to dawn.—EDMUND SELOUS.

NOTICES OF NEW BOOKS.

Reptiles, Amphibia, Fishes, and Lower Chordata. By R. LYDEKKER, J. T. CUNNINGHAM, G. A. BOULENGER, and J. A. THOMSON. Methuen & Co., Ltd.

THIS book is more largely evolutionary in principle and bionomical in treatment than any work of the kind which has appeared in recent years; it marks the trend of modern biological conclusions, and should satisfy the aim of Mr. Pycraft, who projected the series, but owing to ill-health was compelled to hand over the editorship to Mr. Cunningham.

The chapter on the coloration of reptiles and its interpretation is a cautious and well-reasoned summary of a subject which is too often treated with a wealth of theoretical imagination. The solution of the coloration problem cannot be achieved by the study of its appearance in the Insecta alone and in Lepidoptera particularly; it must be studied in a wider field, and will then obtain a wider interpretation. The coloration of fishes is still, in all its phases, a question which has not yet reached a demonstrative explanation.

The evolutionary record of the animals treated in this book is not divorced from palæontology: by a knowledge of the past we can understand the foundations of the present fauna of the planet; when we know it thoroughly, if the past will ever be unravelled, the future will also be divulged. This volume is one

to be read rather than criticised; it contains much information that is not easily accessible, and is written from a sound evolutionary purview. The illustrations are to the point.

At the meeting of the Zoological Society of London (April 23rd, 1912) Mr. Julian S. Huxley read a paper containing an account of the courtship of the Redshank (*Totanus calidris*).

The first purpose of this paper was to draw attention to the many valuable results to be obtained by simple watching of very common British birds; and the second was to show how the facts observed in the Redshank bore on the theory of Sexual Selection. In this species there was no rival display between several males at once: a single female was courted by a single male, as in Man. The courtship started with a pursuit, the hen running in a circuitous course, followed by the cock. The pursuit was followed by a display, but only if the hen were willing that the courtship should continue. During the display the cock uttered a special note, spread his tail, raised his wings above his back, and advanced with a curious high-stepping action towards the now stationary female. If the female so wished, pairing followed the display. But in quite ninety per cent. of observed courtships the female rejected the male, either during the pursuit or during the display, by simply flying away, when the cock was quite powerless to enforce his desires. Thus the consent of the hen was absolutely necessary if pairing were to take place, and this consent was usually withheld; in other words, selection by the female was a reality in the Redshank.

Other interesting points were as follows:—The plumage of the two sexes was identical, and was decidedly cryptic when the birds were at rest. During flight the white under side of the wings and the white tail were conspicuously revealed, and probably served as recognition marks. The significance of the red legs was unknown. During display the male drew attention to the underside of the wings by raising and vibrating them, to the tail by fanning it out, and to the red legs by his slow, high steps; besides this he uttered a note heard at no other time. Thus, since the actual colours and structures used in display were found in both sexes, the only peculiarly male possession—the only secondary sexual character of the Redshank—was a special behaviour, devoted to showing off these common colours and structures in a special way.

This seemed to show that secondary sexual differences in birds were originally differences of behaviour, and that only when these were established did differences of colour and structure come to be developed.

